Using the Mathematics Performance Level Descriptors to Inform Your Instruction

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Agenda

We will be examining the following topics:

- **What are Performance Level Descriptors (PLDs)?**
- **The purpose of PLDs**
- **The tie-in to Evidence Statements**
- **Mathematical Practices**
- **Claims and Sub-claims**
- **How Teachers can use PLDs in their classrooms**
- **Cognitive Complexity in Mathematics**
- **PLDs in Different Grade Levels**
- **Use of Technology**
- **PARCC items**

What are performance level descriptors?

Performance level descriptors (PLDs) describe the skills, knowledge and practices a student who has achieved a particular performance level should be able to demonstrate.

PARCC has two different kinds of PLDs: policy-level PLDs and grade- and subject-specific PLDs.

How many PLDs are there, and what are they?

PARCC will have five performance levels for all assessments, grades 3-8 and high school.

PARCC performance levels:

Level 5 – **Distinguished Command**

Level 4 – **Strong Command**

Level 3 – **Moderate Command**

Level 2 – **Partial Command**

Level 1 – **No work shown to Minimal Command**

What is the purpose of the PLDs?

Communicate expectations to educators about what types of performances will be necessary in:

High school-level for students to demonstrate that they are college- and career-ready (CCR) or making adequate progress to become CCR;

Grades 3-8 for students to demonstrate that they are academically prepared to engage successfully in further studies in each content area;

What is the purpose of the PLDs?

Provide information to local educators for use in developing curricular and instructional materials

Serve as the basis for PARCC standard setting in summer 2015

Inform item and rubric development for the PARCC assessments.

Phrases that distinguish between PLDs

Key words and phrases differentiating expected student performance appear in bold print.

For example, a student performing at Level 3 in Algebra I "calculates sums and products of two rational and/or irrational numbers," while a student performing at Level 4 "calculates sums and products of two rational and/or irrational numbers **and determines whether the sums and products are rational or irrational.**"

Claim and Sub-Claims

Master Claim: Students are on-track or ready for college and careers

Sub-claim A: Students **solve problems involving the major content** for their grade level with connections to practices

Sub-Claim B: Students **solve problems involving the additional and supporting content** for their grade level with connections to practices

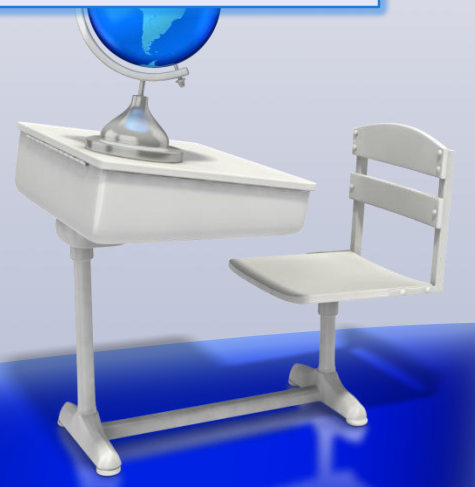
Sub-claim C: Students **express mathematical reasoning** by constructing mathematical arguments and critiques

Sub-Claim D: Students solve real world problems engaging particularly in the **modeling practice**

Sub-Claim E: Student **demonstrate fluency** in areas set forth in the Standards for Content in grades 3-6

Evidence Statements

The inclusion of evidence statements in the PLD documents will allow educators and other stakeholders to more easily see how the PARCC PLDs align with PARCC assessments and the Common Core State Standards (CCSS).



PARCC Items/Tasks

Take a trip to the PARCC site and examine some tasks

www.parcconline.org

Test Blueprints

Video Explanation of Evidence Tables

Processing Demand

Gives the PLD by performance level ranging from 2-5. Level 1 indicates a range from no work shown to Minimal command

Gives the Sub-Claim that the PLD is written for (A-Major Content)

Gives the Conceptual Concept the PLD is based on

Performance Level Descriptors – Grade 4 Mathematics

	Grade 4 Math : Sub-Claim A The student solves problems involving the Major Content for the grade/course with connections to the Standards for Mathematical Practice.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
Fractions and Decimals 4.NF.1-2 4.NF.2-1 4.NF.A.Int.1 4.NF.5 4.NF.6 4.NF.7	Compares decimals to hundredths; uses decimal notations for fractions (tenths and hundredths); compares fractions, with like or unlike numerators and denominators, by creating equivalent fractions with common denominators, comparing to a benchmark fraction and generating equivalent fractions. Recognizes that decimals and fractions must refer to the same whole in order to compare. Shows results using symbols. Demonstrates the use of conceptual understanding of fractional equivalence and ordering when solving simple word problems requiring fraction	Compares decimals to hundredths; uses decimal notations for fractions (tenths and hundredths); compares fractions, with like or unlike numerators and denominators, by creating equivalent fractions with common denominators, comparing to a benchmark fraction and **generating equivalent fractions.** Recognizes that decimals and fractions must refer to the same whole in order to compare. Shows results using symbols. **Demonstrates the use of conceptual understanding of fractional equivalence and ordering when solving** simple word problems requiring fraction	Given a visual model and/or manipulatives, compares decimals to hundredths; uses decimal notations for fractions (tenths and hundredths); compares fractions, with like or unlike numerators and denominators, by **creating equivalent fractions with common denominators** and comparing to a benchmark fraction. Recognizes that decimals and fractions must refer to the same whole in order to compare. Shows results using symbols. **Solves simple word problems requiring fraction comparison.**	Given a visual model and/or manipulatives, compares decimals to hundredths; uses decimal notations for fractions (tenths and hundredths); compares fractions, with like or unlike numerators and denominators by comparing to a benchmark fraction. Recognizes that decimals and fractions must refer to the same whole in order to compare. Shows results using symbols. Solves simple word problems requiring fraction comparison with scaffolding.

Factors that Determine the Performance Levels (Cognitive Complexity) for Math

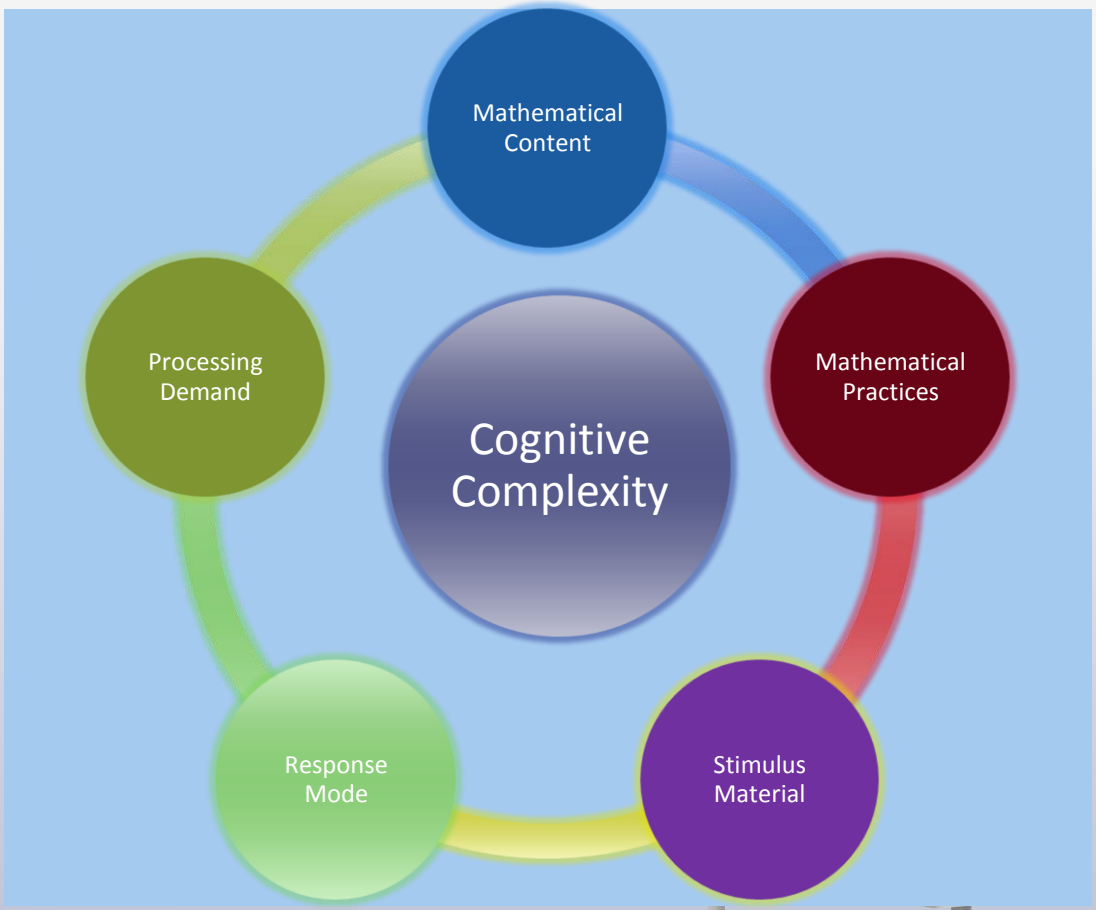
Mathematical Content

Mathematical Practices

Stimulus Material

Response Mode

Processing Demand



Math Content

At each grade level, there is a range in the level of demand in the content standards--from low to moderate to high complexity.

Within Mathematical Content, complexity is affected by:

Numbers: Whole numbers vs. fractions

Expressions and Equations: The types of numbers or operations in an expression or equation (3/7, √)

Diagrams, graphs, or other concrete representations: may contribute to greater overall complexity than simpler graphs such as scatterplots.

Problem structures: Word problems with underlying algebraic structures vs. word problems with underlying arithmetic structures.

Mathematical Practices

MPs involve what students are asked to do with mathematical content, such as engage in application and analysis of the content. The actions that students perform on mathematical objects also contribute to Mathematical Practices complexity.

Low Complexity items primarily involve recalling or recognizing concepts or procedures specified in the Standards.

High Complexity items make heavy demands on students, because students are expected to use reasoning, planning, synthesis, analysis, judgment, and creative thought. They may be expected to justify mathematical statements or construct a formal mathematical argument.

Mathematical Practices

Make sense of problems and persevere in solving them.

Reason abstractly and quantitatively.

Construct viable arguments and critique the reasoning of others.

Model with mathematics.

Use appropriate tools strategically.

Attend to precision.

Look for and make use of structure.

Look for and express regularity in repeated reasoning.

Stimulus Material

This dimension of cognitive complexity accounts for the number of different pieces of stimulus material in an item, as well as the role of technology tools in the item.

Low Complexity involves a single piece of (or no) stimulus material (e.g., table, graph, figure, etc.) OR single online tool (generally, incremental technology)

High Complexity involves two pieces of stimulus material with online tool(s) OR three pieces of stimulus material with or without online tools.

Response Mode

The way in which examinees are required to complete assessment activities influences an item's cognitive complexity.

Low Cognitive Complexity response modes in mathematics involve primarily selecting responses and producing short responses, rather than generating more extended responses.

High Cognitive Complexity response modes require students to construct extended written responses that may also incorporate the use of online tools such as an equation editor, graphing tool, or other online feature that is essential to responding.

Processing Demand

Reading load and linguistic demands in item stems, instructions for responding to an item, and response options contribute to the cognitive complexity of items.

How can teachers use the PLDs in their classrooms?

Classroom teachers can use the PLDs to inform the development of classroom-based formative assessment tools, including the creation of rubrics to gauge student learning against the expectations of the PARCC assessments.

To further aid in this process, when teachers receive data from the assessment on individual students, the teacher can better understand what level of instruction supports students whose performance fits into the same PLD, e.g., all students who score at Level 3 may need to increase achievement in the given content.

Closer Look at the PARCC PLDs

Examine your handout for grades 3, 6, 8, and Algebra.

Take a moment to see a sampling of the 5 sub-claims and how they are used in the PLDs.

PARCC Math PLDs

Example of Grade 3 PLD for Sub-Claim A

	Grade 3 Math : Sub-Claim A The student solves problems involving the Major Content for the grade/course with connections to the Standards for Mathematical Practice.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
Products and Quotients 3.OA.1 3.OA .2 3.OA .4 3.OA .6	Understands and interprets products and quotients of whole numbers. Determines the unknown whole number in a multiplication or division problem by relating multiplication and division. Factors are greater than 5 and less than 10. **Represents the multiplication or division situation as an equation.**	**Understands** and interprets products and quotients of whole numbers. Determines the unknown whole number in a multiplication or division problem by relating multiplication and division. **Factors are greater than 5 and less than 10.**	Interprets products and quotients of whole numbers. Determines the unknown whole number in a multiplication or division problem by relating multiplication and division. **One factor** is less than or equal to 5.	Interprets products and quotients of whole numbers. Determines the unknown whole number in a multiplication or division problem by relating multiplication and division. Limit to factors less than or equal to 5.

Example of Grade 6 PLD for Sub-Claim A

	Grade 6 Math : Sub-Claim A The student solves problems involving the Major Content for grade/course with connections to the Standards for Mathematical Practice.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
Multiplying and Dividing with Fractions 6.NS.1-2	Applies and extends previous understandings of multiplication and division **to create** and solve word problems involving division of fractions by fractions.	Applies and extends previous understandings of multiplication and division to solve word problems involving **division of fractions by fractions.**	Applies and extends previous understandings of multiplication and division to divide fractions **with unlike denominators** and solve word problems with prompting embedded within the problem.	Applies and extends previous understandings of multiplication and division to divide fractions with common denominators and to solve word problems with prompting embedded within the problem.

Example of Algebra PLD for Sub-Claim C

	Algebra I: Sub-Claim C The student expresses course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others and/or attending to precision when making mathematical statements.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
	• using a logical approach based on a conjecture and/or stated assumptions, utilizing mathematical connections (when appropriate) • providing an **efficient and** logical progression of steps or chain of reasoning with appropriate justification • performing precise calculations • using correct grade-level vocabulary, symbols and labels • providing a justification of a conclusion • **determining whether an argument or conclusion is generalizable.**	• using a logical approach based on a conjecture and/or stated assumptions, **utilizing mathematical connections (when appropriate)** • providing a **logical** progression of steps or chain of reasoning **with appropriate justification** • **performing precise calculations** • using **correct** grade-level vocabulary, symbols and labels • providing a **justification** of a conclusion • **evaluating, interpreting and critiquing the validity of others' responses, approaches**	• using a **logical** approach based on a conjecture and/or stated assumptions • providing a **logical, but incomplete,** progression of steps or chain of reasoning • **performing minor** calculation errors • using **some** grade-level vocabulary, symbols and labels • providing a partial justification of a conclusion based on own calculations • **evaluating the validity of others' approaches and conclusions**	• using an approach based on a conjecture and/or stated or faulty assumptions • providing an incomplete or illogical progression of steps or chain of reasoning • making an intrusive calculation error • using limited grade-level vocabulary, symbols and labels • providing a partial justification of a conclusion based on own calculations

Intervention or Enrichment

Educators may note that students whose PLD indicates they are not academically well prepared to engage successfully in further studies in a content area may need instructional interventions while students whose PLD indicates they have strong content skills may need instructional enrichment.

Mathematical Practices Revisited (Reasoning/Modeling)

Make sense of problems and persevere in solving them.

Reason abstractly and quantitatively.

Construct viable arguments and critique the reasoning of others.

Model with mathematics.

Use appropriate tools strategically.

Attend to precision.

Look for and make use of structure.

Look for and express regularity in repeated reasoning.

Steps To Help Students Develop Reasoning

Provide tasks that require students to figure things out for themselves.

Ask students to restate the problem in their own words, including any assumptions that they have made.

Give students time to analyze a problem intuitively.

Resist the urge to tell students how to solve a problem when they become frustrated.

Ask students questions that will prompt their thinking.

(NCTM, 2009, Reasoning and Sense Making)

Steps To Help Students Develop Reasoning

Provide adequate wait time after a question.

Encourage students to ask probing questions of themselves and of their peers.

Establish a classroom climate in which students feel comfortable sharing their mathematical arguments.

(NCTM, 2009, Reasoning and Sense Making)

The Older Generation…

Division of Fractions

"Yours is not to reason why, just ____"

The Older Generation…

Division of Fractions

"Yours is not to reason why, just **invert and multiply**"

The Common Core Way

Division of Fractions

Conceptual Understanding

Steps in Modeling

Analyze the problem

Seek and use connections to prior learning

Choose and Implement a solution strategy

Revise strategy if needed (or choose different one)

Reflect on the solution and the model

Communicate results (verbal/written/symbolic)

Using Technology to Aid Instruction

National Library of Virtual Manipulatives
Math Playground
Wolfram Alpha
Online Graphing Calculator
Geometer's Sketchpad

Any others? Let us add them on the list.

More Items/Tasks

Let us take a trip to the Smarter-Balanced site and examine some tasks which contain modeling.

www.smarterbalanced.org

Illustrative Mathematics

Inside Mathematics

Giving Us Some Perspective

Numbers 11 to 19

Conjecturing About Functions

Stay true to the language of the CCSS

Use formal mathematical terms as directed by the CCSSM

Common Core Vocabulary by Grade Level

Educator Resource Exchange

Help for NJ Educators

- Lessons
- Units
- Assessments
- Videos
- Websites
- Documents

www.njcore.org

Resources

NJ Educator Resource Exchange www.njcore.org

PARCC www.parcconline.org

Smarter Balanced www.smarterbalanced.org

Student Achievement Partners www.achievethecore.org

Engage NY www.engageny.org

Doing What Works www.dww.ed.gov

Illustrative Mathematics http://www.illustrativemathematics.org/

Council of Chief State School Officers http://www.ccsso.org/

Teaching Channel https://www.teachingchannel.org

Institute of Education Sciences http://ies.ed.gov/

National Library of Virtual Manipulatives
http://nlvm.usu.edu/en/nav/vlibrary.html

PARCC Performance Level Descriptors PLD FAQs

Summary

"What did we learn today?"

Some of the things we examined:

- **What are Performance Level Descriptors (PLDs)?**
- **The purpose of PLDs**
- **The tie-in to Evidence Statements**
- **Mathematical Practices**
- **Sub-claims**
- **How Teachers can use PLDs in their classrooms**
- **Cognitive Complexity in Mathematics**
- **PLDs in Different Grade Levels**
- **Use of Technology**
- **PARCC items**
- **Resources**

Feedback

Please take a moment to complete the feedback form:

I will be reading over the comments and gladly accept your feedback.

Contact Me

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